



Modelling radiation fluxes in simple and complex environments--Application of the RayMan model

Author(s): Matzarakis A, Rutz F, Mayer H
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Abstract:

The most important meteorological parameter affecting the human energy balance during sunny weather conditions is the mean radiant temperature $T(mrt)$. It considers the uniform temperature of a surrounding surface giving off blackbody radiation, which results in the same energy gain of a human body given the prevailing radiation fluxes. This energy gain usually varies considerably in open space conditions. In this paper, the model 'RayMan', used for the calculation of short- and long-wave radiation fluxes on the human body, is presented. The model, which takes complex urban structures into account, is suitable for several applications in urban areas such as urban planning and street design. The final output of the model is, however, the calculated $T(mrt)$, which is required in the human energy balance model, and thus also for the assessment of the urban bioclimate, with the use of thermal indices such as predicted mean vote (PMV), physiologically equivalent temperature (PET) and standard effective temperature (SET^*). The model has been developed based on the German VDI-Guidelines 3789, Part II (environmental meteorology, interactions between atmosphere and surfaces; calculation of short- and long-wave radiation) and VDI-3787 (environmental meteorology, methods for the human-biometeorological evaluation of climate and air quality for urban and regional planning. Part I: climate). The validation of the results of the RayMan model agrees with similar results obtained from experimental studies.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Meteorological Factors, Solar Radiation, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

Urban

Geographic Location:

resource focuses on specific location

Climate Change and Human Health Literature Portal

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Germany

Health Impact: 

specification of health effect or disease related to climate change exposure

General Health Impact, Injury, Other Health Impact

Other Health Impact: Heat stress

Model/Methodology: 

type of model used or methodology development is a focus of resource

Methodology

Resource Type: 

format or standard characteristic of resource

Research Article, Research Article

Timescale: 

time period studied

Time Scale Unspecified